



September 21, 2010

EX PARTE NOTICE

Electronic Filing

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW, Room TW-A325
Washington, D.C. 20554

Re: *700 MHz Interoperable Broadband Public Safety Network*
WT Docket No. 06-150, PS Docket No. 06-229,
GN Docket Nos. 09-47, 09-51, 09-137, RM Docket No. 11592

Dear Ms. Dortch:

On September 20, 2010, Prof. Dennis Roberson and Dr. Ken Zduenk of Roberson and Associates, LLC and the undersigned of T-Mobile meet with Jennifer Manner, Deputy Chief, and Gene Fullano, Associate Chief, of the Public Safety and Homeland Security Bureau, and John Leibovitz and Tom Peters of the Wireless Telecommunications Bureau. During the meeting Prof. Roberson and Dr. Zduenk presented the attached overview of their recently filed Whitepaper in these proceedings.

Pursuant to Section 1.1206(b) of the Commission's rules, an electronic copy of this letter is being filed with the office of the Secretary.

Respectfully submitted,

/s/ Kathleen O'Brien Ham
Kathleen O'Brien Ham
Vice President,
Federal Regulatory Affairs
T-Mobile USA, Inc.
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Roberson and Associates, LLC

Technical Analysis of the Proposed D-Block Action

Prepared for T-Mobile, USA
by Roberson and Associates, LLC

Motivation for Technical Analysis

- T-Mobile sought assistance in assessing technical issues around D-Block allocation
- Roberson and Associates, LLC performed a preliminary analysis
 - Determined that a more technically inclusive perspective than done previously was warranted
 - A broader technical perspective would allow better and more informed decision making

NBP and FCC Plan

- National Public Safety Broadband Network
 - 5 + 5 MHz
- Create Rules for Public Safety Roaming to Commercial D-Block
- Co-Location of D-Block and Public Safety Base Sites
- Create Incentive-Based Partnerships with Service Providers
 - Public Funding Support for Construction of PS Network

Overall Benefit of D-Block Auction

- 700 MHz Provides Unique Opportunity to Satisfy Public Safety Needs and Provide Commercial Benefit
 - Both Public Safety and adjacent D-Block will use LTE technology, allowing Public Safety additional capacity in emergencies
 - LTE economies of scale will make leading-edge capabilities available to Public Safety at lower cost

Summary of Findings

- Public Safety Video Capacity
 - FCC Analysis is sound: Only recent, realistic, systematic assessment
 - Multiple Video Streams provided by 10 MHz
 - 50 MHz of 4.9 GHz Spectrum provides local area video for compact incident scenes: complements 700 MHz wide-area
 - For future integrated Voice-Video network, repurposing narrowband voice spectrum should be considered
- Use of D-Block by Public Safety Via LTE
 - 15 LTE access classes and 9 bit rate levels give sufficient priority for public safety
 - LTE can prevent low-priority users from clogging the access channel in emergencies
 - LTE provides for entering high-priority streams to slow down lower priority users
- Interference
 - D-Block effect on Public Safety Broadband
 - Previous analysis was worst case, not realistic
 - D-Block effect on GPS receivers
 - Can be addressed in device design

Conclusions

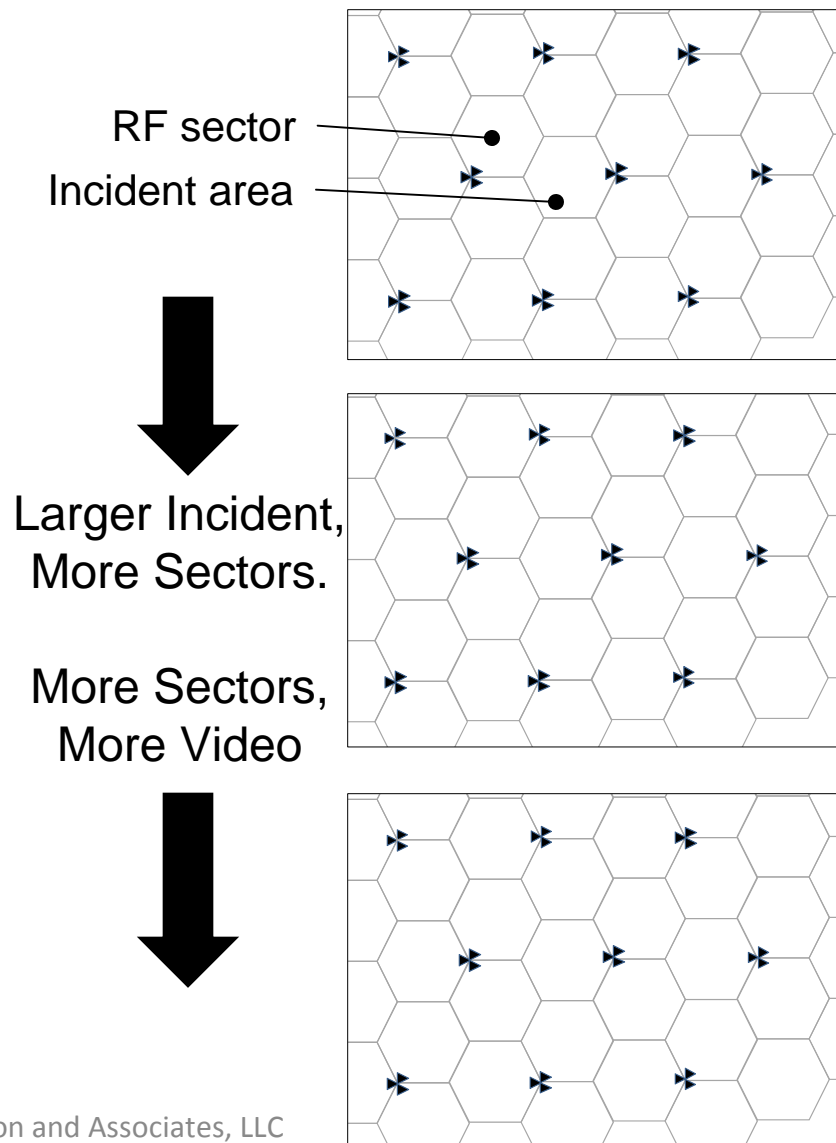
Considering the Requirements of Public Safety

- There are no technical impediments to
 - Auctioning D-Block to Commercial Use
 - Using D-Block Networks for Public Safety during major emergencies
- There is sufficient dedicated wide-area public safety broadband capacity in 10 MHz at 700 MHz to meet day-to-day video needs

Video Capacity

Reality:

- The number of RF Sectors serving an incident increases as the geographic area of the incident increases
- The video capacity available for an incident increases as the incident area increases
- Smaller incident areas are suitable for 4.9 GHz local networks
- Multi-band wireless routers exist



High Quality Video Streams Provided by 10 MHz Public Safety Broadband Network

Calculation:

$$N_{\text{video streams}} = \frac{\text{Link Capacity}}{\text{Video Rate}} \times \text{Number of Sectors for Incident}$$

$$\text{Number of Sectors for Incident} = \frac{\text{Area of Incident}}{\text{Area of Sector}}$$

Assumptions:

- 1.2 Mbps Video Rate (high quality)
- 7.5 Mbps avg. LTE Down-Link Capacity
- 3.5 Mbps avg. LTE Up-Link Capacity
- 3 RF sectors per cell
- Sector Area = cell area / 3

High Quality Video Streams Provided by 10 MHz Public Safety Broadband Network

- The number of video streams available for an incident increases as the area of the incident increases
 - More RF sectors serve the incident

		Potential Number of RF Sectors Serving an Incident				Potential Number of 1.2 Mbps Downlink Streams				Potential Number of 1.2 Mbps Uplink Streams			
Cell Size (radius, meters)	RF Sector Area (sq. miles)	Incident Area (sq. miles)				Incident Area (sq. miles)				Incident Area (sq. miles)			
		0.5	1	2	4	0.5	1	2	4	0.5	1	2	4
500	0.10	4	9	19	39	25	56	118	243	11	26	55	113
750	0.23	2	4	8	17	12	25	50	106	5	11	23	49
1000	0.41	1	2	4	9	6	12	25	56	2	5	11	26
1500	0.92	1	1	2	4	6	6	12	25	2	2	5	11

Reality: Significant number of video streams are available with 10 MHz spectrum.

Public Safety Voice Capacity Assessment

Epoch 2,3: Effect of Narrowbanding:

$$\text{Number of Voice Channels} = \frac{\text{RF Bandwidth} / 2}{6.25 \text{ kHz} / \text{voice channel}}$$

	Epoch 1 Current Narrowband Spectrum (25kHz voice bandwidth)			Epoch 2 Available Narrowband Spectrum (6.25 kHz voice bandwidth below 800 MHz) (without 700 MHz spectrum)			Epoch 3 Available Narrowband Spectrum (6.25 kHz voice bandwidth below 800 MHz) (with 700 MHz spectrum)		
	Current Spectrum (MHz)	Current Voice Channels /Area	Approx Users/ Service Area	Available Spectrum (MHz)	Available Voice Channels/Area	Approx Users/ Service Area	Available Spectrum (MHz)	Available Voice Channels/Area	Approx Users/ Service Area
Narrowband Spectrum									
25-50	6.3			6.3			6.3		
138-144/148-174	3.6			3.6			3.6		
220-222	0.1			0.1			0.1		
450-470	3.7	74	5,180	3.7	296	20,720	3.7	296	20,720
806-821/851-866	3.5	70	4,900	3.5	70	4,900	3.5	70	4,900
821-824/866-869	6.0	120	8,400	6.0	120	8,400	6.0	120	8,400
806-824/851-869 (reconfiguration)				4.5	90	6,300	4.5	90	6,300
Total Narrowband w/o 700 MHz	23.2	264	18,480	27.7	576	40,320	27.7	576	40,320
700 MHz Narrowband							12	960	67,200
Total Narrowband w. 700 MHz				39.7	1536	107,520			

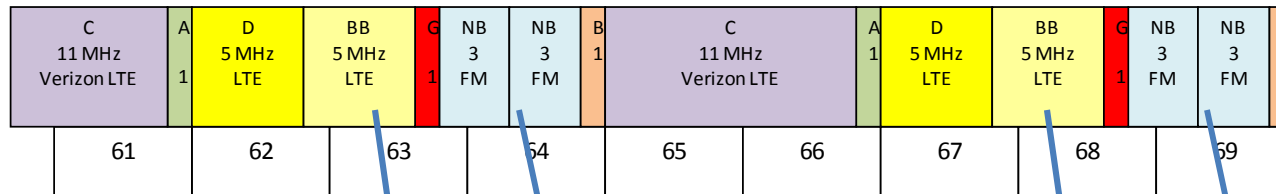
700 MHz
alone provides
1.75x current
Voice chls.

700 MHz
provides
2.75x current
voice chls.

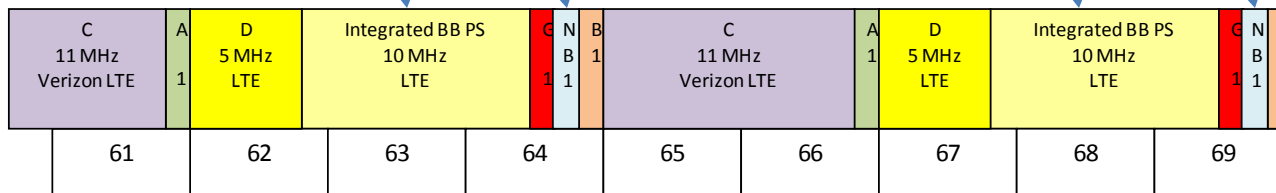
- The 700 MHz channel calculation reflects a 6.25 kHz BW requirement. Whitepaper incorrectly used 25 kHz.

Future: Repurposing Narrowband Voice Spectrum to provide Integrated Voice-Data Network

Existing Bandplan, 700 MHz



Potential Future Bandplan, 700 MHz, Providing for 20 MHz integrated voice, data, broadband network

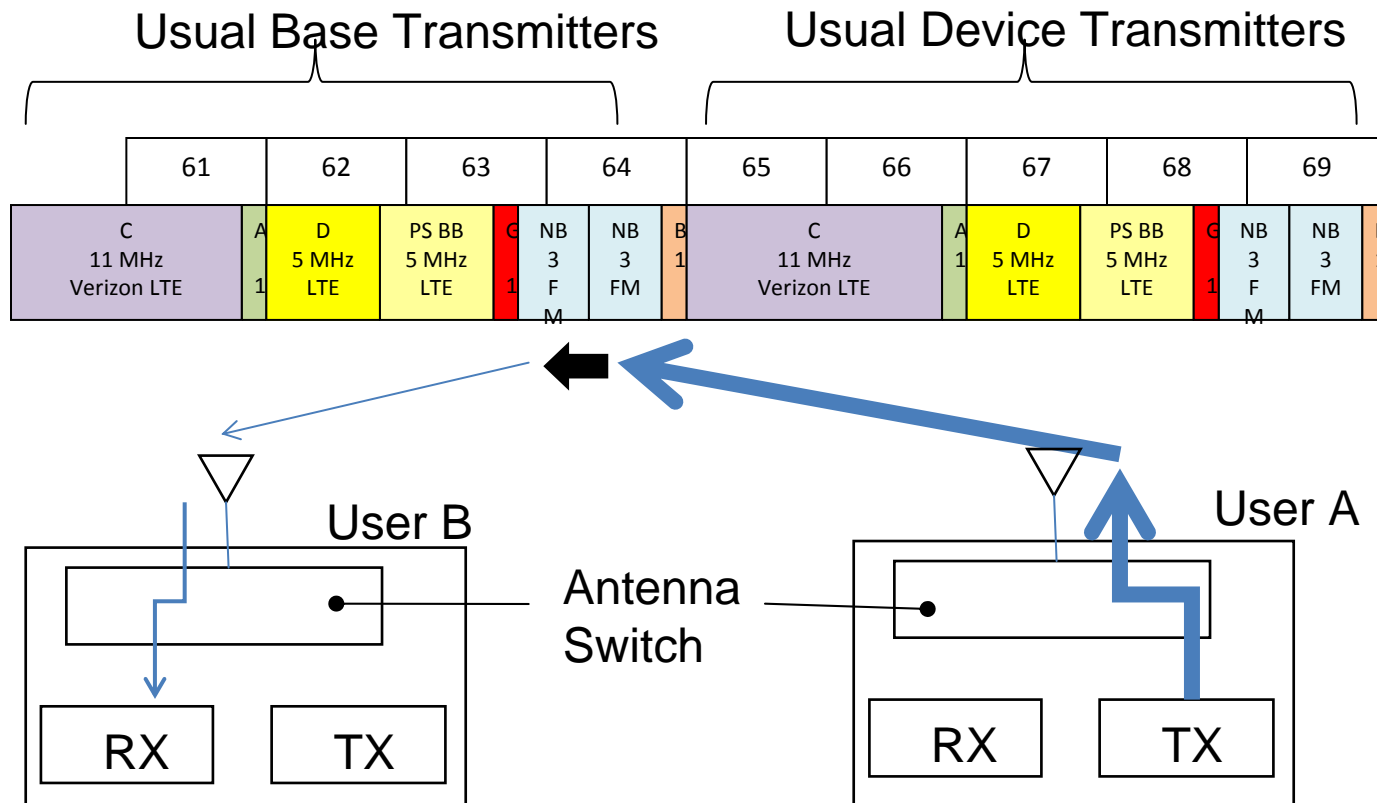


Future: 2 MHz of Narrowband Voice still provides 160 narrowband communication channels.

20 MHz Public Safety network can accommodate BOTH voice and video.

Talk-Around: Non-Network Operation

- Essential public safety *voice* capability



Reality

- Devices can be designed for both LTE, and off-network modes. (similar devices are commercially available today)

Operation

- User Device "A" Transmits Directly to User Device "B" on Frequency Normally Used by the Base Station
- Device Cannot Transmit and Receive Simultaneously

Future: Effect of Repurposing Narrowband Spectrum

Potential Long-Term Future Available Narrowband Spectrum (6.25kHz voice bandwidth below 800 MHz) (with 700 MHz spectrum)			
	Available Spectrum	Available Voice Channel Equivalent	Approx Users/Service Area
Narrowband Spectrum			
25-50	6.3		
138-144/148-174	3.6		
220-222	0.1		
450-470	3.7	296	20,720
806-821/851-866	3.5	70	4,900
821-824/866-869	6	120	8,400
806-824/851-869 (reconfiguration)	4.5	90	6,300
Total Narrowband w/o 700 MHz	27.7	576	40,320
700 MHz Narrowband	2	160	11,200
Total Narrowband w. Alt. 700 MHz	29.7	736	51,520

160 narrowband voice channels remain at 700 MHz

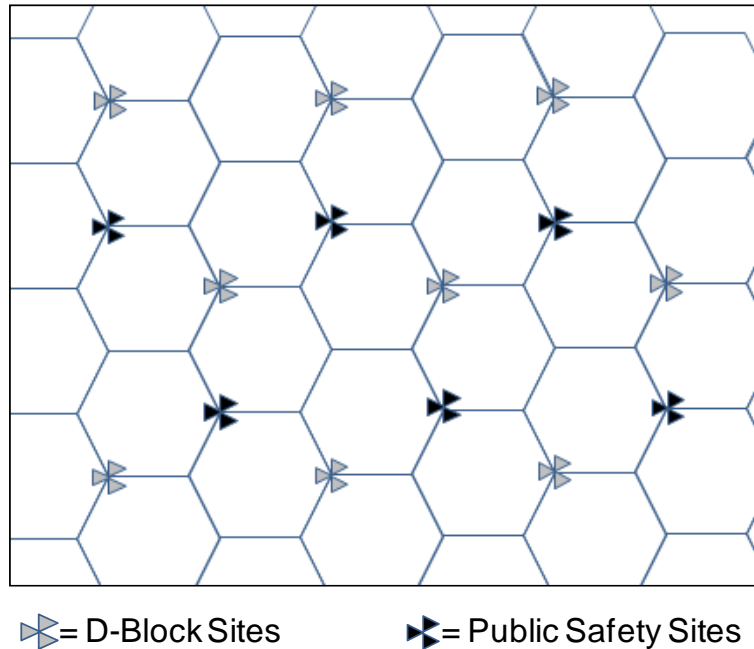
736 total narrowband voice channels

Use of D-Block by Public Safety

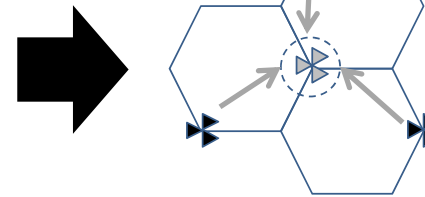
- LTE Characteristics
 - Packet nature of LTE allows Public Safety information streams to be added on-the-fly to busy channels
 - Low priority users can be inhibited from transmitting during congested periods
 - Access to Public Safety users is always assured
 - 15 Priority Classes and 9 bit rate levels provide necessary priorities for Public Safety
- Standards
 - LTE Standards activity underway for emergency uses
 - NGN GETS (Next Generation GETS) underway
- Public Safety to D-Block Switching
 - Over the air dynamic reprogramming of devices is used
 - Use of communication “storm plans” is well known

Previous Interference Analysis - D-Block Effect on Public Safety

Cell-Site Configuration for Analysis of
D-Block to PSST Interference



Configuration is Worst-Case
Situation for Interference



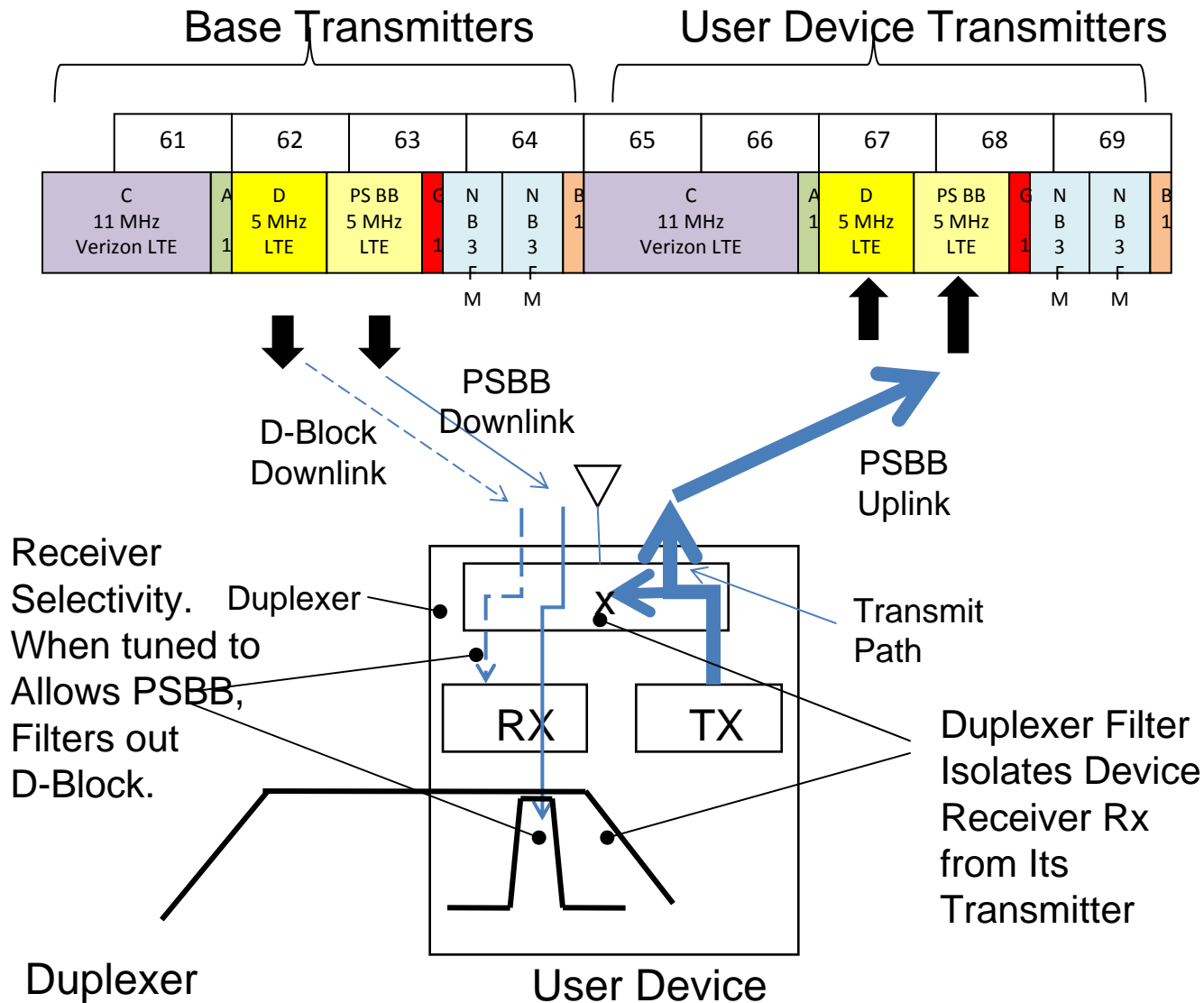
D-Block Sites are systematically
placed where signals from
Public Safety Sites are weakest
and most vulnerable to interference
(D-Block Sites are at edge of
Public Safety Site coverage)

Worst-case
analysis
is unrealistic

Figure: Analysis of Cell Site Configuration Used in Previous Interference Analysis

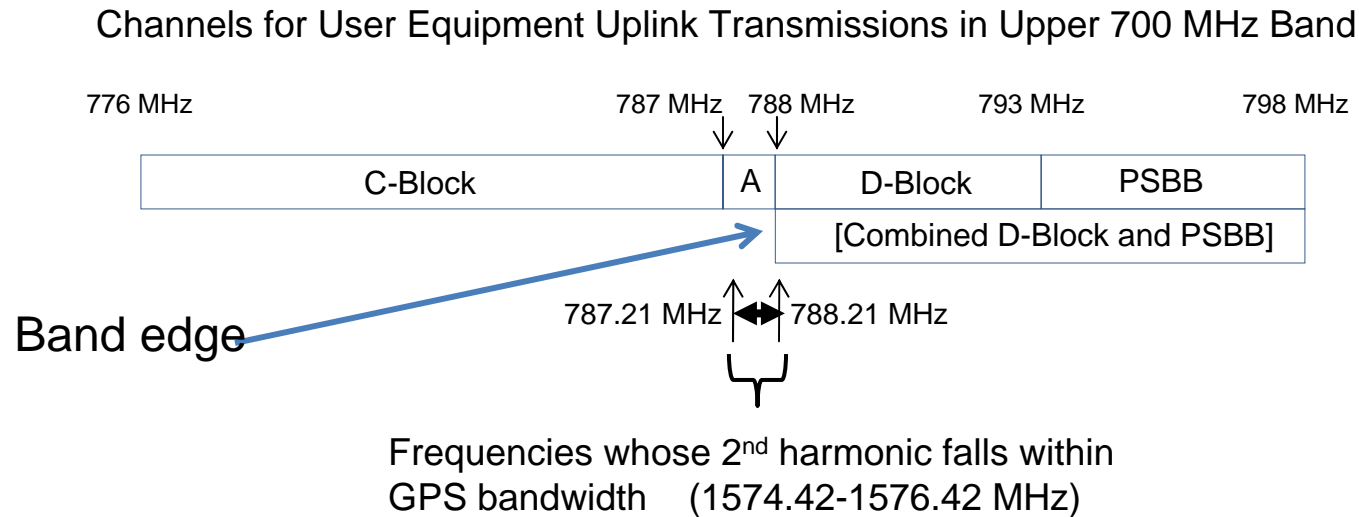
- Reality: LTE air interface has been designed for adjacent networks in adjacent bands
 - D-Block and Public Safety network use similar cell sizes, or co-located sites
- 800 MHz experience is irrelevant: Completely different system configuration there.

Function of Duplexer Filter



- Reality: The Duplexer is not the main adjacent band interference element

GPS Interference Relationships at 700 MHz



Reality

- From an interference standpoint, there is little difference between a separate D-Block, and a combined D- and Public Safety Block
 - Both band edges are in the same place
- Any issues can be addressed during device design

Myth and Reality

Capacity

Issue(Myth)	Solution(Reality)
<ul style="list-style-type: none"> • Insufficient throughput at cell edge • Insufficient capacity for compact incident scene in single sector. • 4.9 GHz not usable for emergency incidents • Multi-band wireless routers are infeasible • FCC Whitepaper Analysis is Naïve • Cannot provide talk-around voice • Additional Spectrum Needed for Public Safety Video 	<ul style="list-style-type: none"> ➤ Gain antennas & mobile pico-cells ➤ Existing bandwidth, mobile pico-cells, and 4.9 GHz provide ample capacity ➤ 4.9 GHz suited to compact incidents and backhaul; complements 700 MHz. ➤ Multi-band wireless routers exist today ➤ Whitepaper is best recent systematic & objective analysis of specific public safety scenarios ➤ Network/ Non-Network devices exist today ➤ Additional spectrum only desirable if voice is added to network.

LTE

Issue(Myth)	Solution(Reality)
<ul style="list-style-type: none"> • Insufficient priorities on LTE • Public Safety Users will be blocked during emergencies • No standards/policies for public safety priority on LTE exist • No mechanism to switch public safety users to commercial network. 	<ul style="list-style-type: none"> ➤ 15 Access classes and 9 bit rate levels ➤ LTE packet mode inhibits low priority users, allows high-priority streams on –the-fly ➤ 3GPP work item well underway; NGN GETS activity is addressing. ➤ Automatic reconfiguration of devices and “storm plans” are well known.

Interference

Issue(Myth)	Solution(Reality)
<ul style="list-style-type: none"> • D-Block will interfere with Public Safety • D-Block devices will interfere with their own GPS receivers. 	<ul style="list-style-type: none"> ➤ LTE Designed for adjacent-band systems ➤ No difference if bands are combined.. Any issues can be addressed during design.